

Compact variable rate laser for space application

Completed Technology Project (2014 - 2015)



Project Introduction

We will focus on the development and test of high reliable, radiation tolerant, compact laser for planetary mission. The laser will be able to operate at variable repetition rate between 8Hz to 128Hz. We will build a brassboard laser and test the laser for Dry Heat Microbial Reduction (DHMR), which is required by planetary protection.

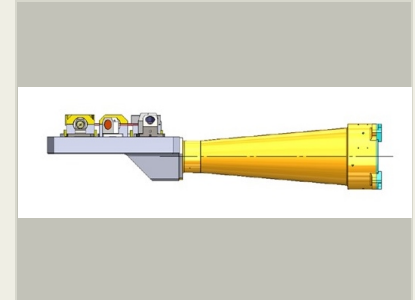
GSFC is actively developing a lidar instrument concept for the planetary missions. The mission consists of multiple flybys which poses special challenges for the laser altimeter to measure the global shape and detect the body tide. GSFC team proposes a novel approaches of extended range laser altimeter, which can support and enhance the science goals. The required laser for the mission should be capable of variable fire rates (8Hz to 128Hz) and pulse energies from 1.2mJ to 25mJ under the same total electrical power consumption. This differs from all previous lasers, GLAS, MLA and LOLA which are fired at a constant rate and pulse energy. Another challenging requirement is the planetary protection. The laser is required to survive the DHMR process multiple times. During DHMR process, the laser is baked at 135°C for 64.2 hours. Instrument for planetary mission will also see harsh radiation environment. The laser needs to survive with very high radiation dose of 3 Mrad, which is 100X of MLA and GLAS requirement.

We have successfully completed a laser breadboard development and demonstrated required laser performance for the mission under NASA HQ ICEE program effort. The laser operates at variable repetition rate from 8Hz to 128 Hz. At high repetition rate, 32Hz to 128Hz, laser outputs 1.5mJ per pulse. At lower rate, it outputs 30mJ per pulse. This laser is based on heritage of Mercury Laser Altimetry (MLA) and Geoscience Laser Altimeter System (GLAS) laser design incorporated with technologies developed from Laser Reduction Program (LRRP).

For FY15 IRAD opportunity, we propose to build a brassboard laser for DHMR bake test (135C for 64.2 hours) which we did not address under the current ICEE program. We have very limited experience at GSFC for laser DHMR qualification. This IRAD effort will help us to gain critical experience and reduce the risk for missions require planetary protection. The resultant laser will provide NASA GSFC a new and better laser transmitter for future planetary lidar that can operate at different pulse rate, rad-hard, and meet the planetary protection requirements.

Anticipated Benefits

This IRAD effort will help us to gain critical experience for laser Dry Heat Microbial Reduction (DHMR) qualification and reduce the risk for missions require planetary protection. The resultant laser will not only help FLARE (Flyby for Altimetry and Radiometry at Europa), but also provide NASA GSFC a new and better laser transmitter for future planetary lidar that can operate at



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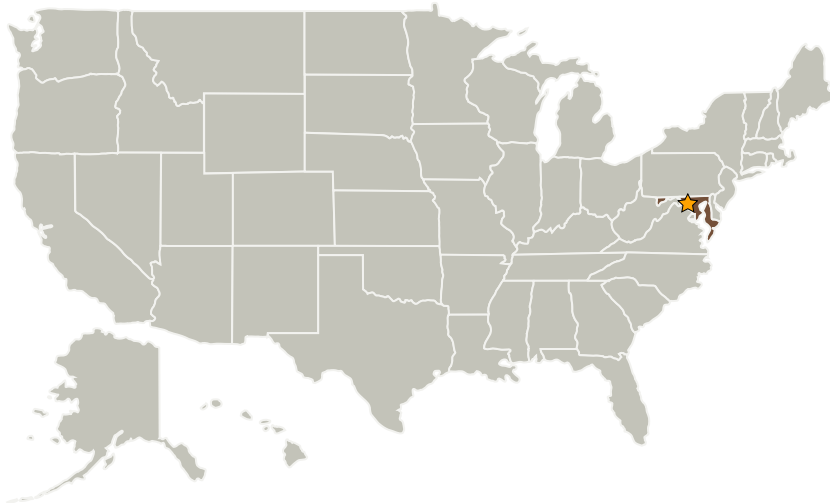
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different pulse rate, rad-hard, and meet the planetary protection requirements.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Goddard Space Flight Center (GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations

Maryland

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Manager:

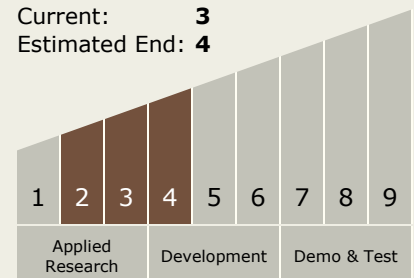
Terence A Doiron

Principal Investigator:

Steven X Li

Technology Maturity (TRL)

Start: 2
Current: 3
Estimated End: 4

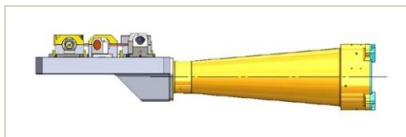


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Images



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(<https://techport.nasa.gov/image/16553>)

Links

GSC-15652

(no url provided)

GSC-15654

(no url provided)

Project Website:

<http://sciences.gsfc.nasa.gov/sed/>

Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.5 Lasers